

What is claimed is:

1                   1.     A method for displaying a predictively coded compressed video signal  
2     in a reverse time sequence comprising the steps of:

3                   decoding and storing any I-frames and P-frames from a first group of pictures  
4     (GOP) upon initiation of a reverse play command; and

5                   after storing the decoded I-frames and P-frames from the first GOP, displaying  
6     video images from the first GOP in the reverse time sequence, including the steps of:

7                   decoding any bidirectionally predictively encoded frames (B-frames)  
8     using the stored I-frames and P-frames and displaying the B-frames as they are  
9     decoded;

10                  displaying the stored I-frames and P-frames of the first GOP as they  
11     are encountered in the reverse time sequence; and

12                  while displaying the I-frames and the P-frames, decoding and storing  
13     respective I-frames and P-frames from a second GOP, following the first GOP in the  
14     reverse time sequence.

1                   2.     A method according to claim 1 wherein:

2                   the step of decoding and storing the I-frames and P-frames includes the step of  
3     downsampling the decoded I-frames and P-frames to produce respective downsampled I-  
4     frames and P-frames and storing the downsampled I-frames and P-frames;

5                   the step of decoding the B-frames includes the step of filtering the decoded B-  
6     frames to display a reduced-resolution image; and

7                   the step of displaying the I-frames and the P-frames includes the step of  
8     upsampling the stored I-frames and P-frames to provide respective reduced-resolution images  
9     for display.

1                   3.     A method according to claim 1, wherein the predictively coded  
2 compressed video signal is an MPEG compressed video signal and the steps of decoding I-  
3 frames and P-frames include the step of applying an MPEG decoding process.

1                   4.     A method for displaying an MPEG coded compressed video signal in a  
2 reverse time sequence comprising the steps of:

3                   retrieving a first group of pictures (GOP) upon initiation of a reverse play  
4 command, the retrieved first GOP being the GOP displayed immediately preceding the  
5 command;

6                   decoding any I-frames and P-frames of the first GOP and storing them in a  
7 memory;

8                   displaying the decoded I-frames and P-frames of the first GOP as the I-frames  
9 and P-frames are encountered in the reverse time sequence;

10                  constructing and displaying any B frames of the first GOP as the B-frames are  
11 encountered in the reverse time sequence; and

12                  decoding I-frames and P frames of a second GOP and storing the decoded I-  
13 frames and P-frames of the second GOP in the memory, the second GOP being a next  
14 preceding GOP, wherein each I-frame and P-frame of the second GOP is decoded while a  
15 respective one of the I-frames and P-frames of the first GOP is being displayed.

1                   5.     A method according to claim 4 wherein:

2                   the step of decoding and storing the I-frames and P-frames of the first GOP  
3 includes the step of downsampling the decoded I-frames and P-frames of the first GOP to  
4 produce downsampled key frames and storing the downsampled key frames;

5                   the step of decoding the B-frames includes the step of filtering the decoded B-  
6 frames to display a reduced-resolution image; and

7 the step of displaying the I-frames and the P-frames includes the step of  
8 upsampling the stored I-frames and P-frames to display respective reduced-resolution images.

1 6. Apparatus which displays a predictively coded compressed video signal  
2 in a reverse time sequence comprising:

3 a video decoder which decodes intra-coded frames (I-frames) and predictively  
4 coded frames (P-frames) from a first group of pictures (GOP) upon initiation of a reverse  
5 play command;

6 a memory into which the video decoder stores the decoded I-frames and P-  
7 frames of the first GOP;

8 means for displaying a frame stored in memory while the I-frames and P-  
9 frames of the first GOP are decoded; and

10 a controller that controls the video decoder, the memory and the means for  
11 displaying such that, after the decoded I-frames and P-frames of the first GOP have been  
12 stored, the controller:

13 a) controls the video decoder to decode bidirectionally predictively  
14 encoded frames (B-frames) using the stored key frames and controls the means for  
15 displaying to display the B-frames as they are decoded;

16 b) controls the means for displaying to display the I-frames and P-  
17 frames from the memory as they are encountered in the reverse time sequence; and

18 c) controls the decoder and the memory to decode and store I-frames  
19 and P-frames from a second GOP, following the first GOP in the reverse time  
20 sequence, while respective ones of the I-frames and P-frames of the first GOP are  
21 displayed.

1 7. Apparatus according to claim 6 further including:

2 a filter, coupled to the decoder for generating respective reduced-resolution  
3 versions of the decoded I-frames, P-frames and B-frames; and

4 a downsampler which decimates the reduced-resolution versions of the  
5 decoded I-frames and P-frames before the I-frames and P-frames are stored in the memory.

1 8. Apparatus for displaying a predictively coded compressed video signal  
2 in a reverse time sequence comprising:

3 means for decoding and storing any I-frames and P-frames from a first group  
4 of pictures (GOP) upon initiation of a reverse play command; and

5 means for displaying video images from the first GOP in the reverse time  
6 sequence, including:

7 means for decoding any bidirectionally predictively encoded frames (B-  
8 frames) using the stored I-frames and P-frames and for displaying the B-frames as they are  
9 decoded;

10 means for displaying the stored I-frames and P-frames of the first GOP  
11 as they are encountered in the reverse time sequence; and

12 means for decoding and storing I-frames and P-frames from a second  
13 GOP, following the first GOP in the reverse time sequence, while the means for displaying  
14 the stored I-frames and P-frames displays respective ones of the I-frames and the P-frames of  
15 the first GOP.

1 9. Apparatus according to claim 8 wherein:

2 the means for decoding and storing the I-frames and P-frames includes means  
3 for downsampling the decoded I-frames and P-frames to produce respective downsampled I-  
4 frames and P-frames and means for storing the downsampled I-frames and P-frames;

5           the means for decoding the B-frames includes filtering means for filtering the  
6   decoded B-frames to display a reduced-resolution image; and

7           means for displaying the I-frames and the P-frames includes upsampling  
8   means for upsampling the stored downsampled I-frames and P-frames to provide respective  
9   reduced-resolution images for display.

1           10.   A computer-readable carrier including computer program instructions  
2   that cause a computer to perform a method of displaying an MPEG coded compressed video  
3   signal in a reverse time sequence, the method comprising the steps of:

4           retrieving a first group of pictures (GOP) upon initiation of a reverse play  
5   command, the retrieved first GOP being the GOP displayed immediately preceding the  
6   command;

7           decoding any I-frames and P-frames of the first GOP and storing them in a  
8   memory;

9           displaying the decoded I-frames and P-frames of the first GOP as the I-frames  
10   and P-frames are encountered in the reverse time sequence;

11          decoding and displaying any B frames of the first GOP as the B-frames are  
12   encountered in the reverse time sequence; and

13          decoding I-frames and P frames of a second GOP and storing the decoded I-  
14   frames and P-frames of the second GOP in the memory, the second GOP being the next  
15   preceding GOP, wherein each I-frame and P-frame of the second GOP is decoded while a  
16   respective one of the I-frames and P-frames of the first GOP are being displayed.